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of Engineers®**
Walla Walla District

LITTLE GOOSE LOCK AND DAM REMOVABLE SPILLWAY WEIR

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VALUE ENGINEERING REPORT



**Little Goose Lock and Dam
Starbuck, Washington**

August 2007

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**U.S. Army Corps of Engineers, Walla Walla District
LITTLE GOOSE LOCK AND DAM
REMOVABLE SPILLWAY WEIR**

STARBUCK, WASHINGTON

**VALUE ENGINEERING STUDY
July 2007**

SPONSOR: The U.S. Army Engineering District, Walla Walla

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REMOVABLE SPILLWAY WEIR**

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Executive Summary

The Value Engineering (VE) Study was conducted at the Walla Walla District (NWW) on June 12-14, 2007. The study was based on 60 percent drawings and specifications dated May 29, 2007. The VE team was comprised of members of three Districts. The team was represented by structural, mechanical, civil, and hydraulic engineers. The team also had the benefit of the quality assurance/weld inspector that witnessed the entire fabrication, painting, and land transport of the prior three Removable Spillway Weir (RSW) projects. The VE team completed Information, Speculation, and Analysis, as well as initiated the Development phase. More cost detail was added to the proposals by various team members in the following weeks. The final draft report was prepared in July 2007.

The project was studied using the Corps of Engineers standard VE methodology, consisting of five phases:

Information Phase: The team studied drawings, figures, descriptions of project work, and cost estimates to fully understand the work to be performed and functions to be achieved.

Speculation Phase: The team speculated by conducting brainstorming sessions to generate ideas for alternative designs. All team members contributed ideas and critical analysis of the ideas was discouraged.

Analysis Phase: Evaluation, testing, and critical analysis of all ideas generated during speculation was performed to determine potential for savings and possibilities for risk. Ideas that were not considered viable as a proposal were eliminated from consideration, or presented as a comment to the design team.

Development Phase: The priority ideas were developed into written proposals by VE team members. Proposal descriptions, along with sketches, technical support documentation, and cost estimates were prepared to support implementation of ideas. Comments were included for items of interest that were not developed as proposals, and are included in the section following the proposals.

Presentation Phase: Presentation is a two-step process. First, the VE Study Report will be distributed for review to all appropriate project supporters and decision-makers. Review comments will be coordinated for decision on any proposals recommended by the study report. Final coordination will include a presentation conference for recommendation of actions to be taken on specific VE proposals.

Summary of Recommendations

| <u>PROPOSAL NUMBER</u> | <u>DESCRIPTION</u> | <u>POTENTIAL SAVINGS</u> | <u>RECOMMENDED ACTION</u> |
|--------------------------------|-----------------------------------|------------------------------|-------------------------------|
| VE-1 | Paint Coating Options | \$50,700 | <u>Recommended</u> |
| VE-2 | Eliminate Radiographic Weld Tests | \$107,123 | <u>Recommended</u> |
| VE-3 | Boat Containment Boom | \$613,600 | <u>Recommended</u> |
| VE-4 | Change from compressor to blowers | \$0 | <u>Dropped</u> |
| VE-5 | Mechanical banded connections | \$unknown | <u>Partial – see comments</u> |
| VE-6 | Change from SST to Clad SS plate | \$0 | <u>Dropped</u> |
| Total anticipated cost savings | | \$771,423 | |

Project Description and Background

Little Goose Lock and Dam

Little Goose Lock and Dam (Little Goose), near Starbuck Washington, is located on the Lower Snake River near river mile 70 upstream of the confluence of the Columbia River. There are more than 4,800 acres of Corps-managed lands surrounding the dam and its reservoir, Lake Bryan. The reservoir extends 37.2 miles upstream of the dam. The dam has six 135-megawatt generators and a 100-foot-high, 86-foot-wide single-lift navigation lock. The spillway has eight spillbays. The four lock and dams on the Lower Snake River are all "run-of-river" facilities, which mean they have limited storage capacity in their reservoirs and pass water through the dam at approximately the same rate as it enters the reservoir. All four of these dams are multiple-use facilities that provide navigation, hydropower, irrigation, recreation, and fish and wildlife conservation benefits. Little Goose began service in 1970.

Salmon and Steelhead 101

After reaching a level of maturity, juvenile salmon and steelhead begin a migration from the fresh water streams and rivers to the Pacific Ocean. Salmon and steelhead use these rivers as rearing and spawning habitat, as well as the pathway to the fertile feeding ground in the oceans. Historically, these fish had unimpeded passage downstream to the ocean and back upstream to their rearing grounds as adults.

All species of fish that are reared in fresh water, reach maturity in salt water, then return to fresh water as spawning adults are called "anadromous" fish, including salmon and steelhead.

As the Pacific Northwest became inhabited and tamed by pioneers, many human factors began a severe decline in these species. Gillnetting practices and massive canneries nearly drove both salmon and steelhead to extinction in the late 1800s. Logging practices over the last 150 years has damaged lands adjacent to spawning grounds and reduced water quality needed for spawning and rearing of the juvenile fish. Ranching and farming practices have introduced biological waste and chemical pollutants into the river systems, and made river banks unstable allowing more silt into the once clear running streams. Many other species of fish have been intentionally or unintentionally introduced into the river basins, adding competition for food and river beds needed to sustain the populations. Water needed for farming has reduced the river flows and increased water temperatures of the streams and rivers. Severe drought periods have also played a role in fish survival, compounded by the human demand for water.

In addition to all these factors, major hydroelectric dams were introduced into the lower Columbia River, starting at Bonneville Lock and Dam in the 1930s and continued in all major and minor tributaries in the Pacific Northwest basins. By the late 1970s, hundreds of dams of various sizes and purposes exist in the areas that were once free-flowing streams creating severe impediments for anadromous fish migrations.

Many of the dams and all of the large Federal dams on the Columbia and Snake Rivers were constructed with fish "ladders" to allow adult fish to return from the ocean to their natural spawning grounds. These ladders have essentially eliminated the upstream migration impediment for adult fish, with approximately 99 percent survival of adults passing upstream of the dams.

However, the original dam designs did not consider juvenile fish passage downstream to the ocean. It was assumed that the small and frail fish could successfully pass through the turbines and spillways with acceptable levels of injury or mortality. In the 1970s a sharp decline in returning salmon and steelhead caused several actions to begin at the Federal dams. Several species of fish were listed as threatened or endangered by National Marine Fisheries Service under the Endangered Species Act. In response, a system of collecting and barging fish to the oceans was created to reduce the numbers of fish passing through the turbines. Spilling at the dams was used to pass fish during peaks of migration in the spring. Spilling practices have increased to a point where some dams are operated more for fish passage than power generation. Costs of spill are huge in terms of "lost opportunity" for power generation. Spilling large quantities of water over spillways also reduces water quality of the rivers by supersaturating the rivers with nitrogen and other gases.

Much of this was not well understood by the scientific communities, the power marketing companies, and the owners and operators of the dams. Fish passage at hydroelectric dams remains a difficult scientific, political, and legal debate.

Since the 1970s, many other actions have improved juvenile fish survival as they pass over the dams. In addition to the fish collection and transport systems, modifications to spillways have been successfully added at many locations. Bypass systems have been added at turbine intakes that guide fish away from the turbines, into pipes and flumes, and released into the tailraces below the dams. Spilling patterns and practices have been shaped to reduce the accumulations of dissolved gases in the river to levels that reduce direct mortality of the juvenile fish. Over many years, mechanisms for injury and mortality have been identified to allow operations of both turbines and spillways to be managed to reduce harm to the fish. These and other practices and improvements have raised direct survival of out migrating fish to well over 90-percent. While this seems high, many fish are injured or die in the long journeys between dams, especially due to predation by fish and birds. And, even a small percentage of mortality translates into millions of fish due to the large numbers of fish needed to sustain a returning adult population.

Surface Bypass and Spillway Weirs

In the 1990s efforts began to create "surface passage" methods as an efficient and effective way to allow fish to pass the dams. Through research, it was discovered that a high percentage of the fish populations travel in the upper 30 feet of the water column as they migrate downstream to the ocean. At both the spillways and turbines, the juvenile fish must dive to depths of 50 to 60 feet to find the passage routes. For the past several years, engineers and biologists have been pursuing new technologies that would provide more surface-oriented, less stressful, passage routes for juvenile fish.

A prototype spillway weir was installed at Lower Granite Lock and Dam (Lower Granite) on the lower Snake River in 2001. The spillway weir, or fish slide, allows juvenile salmon and steelhead to pass the dam near the water surface under lower accelerations and lower pressures, providing a more efficient and less stressful dam passage route. The design of the spillway weir is different from existing spillways whose gates open 50 feet below the water surface at the face of the dam and pass juvenile fish under high pressure and high velocities. The fish slide passes juvenile salmon and steelhead over a raised spillway crest, similar to a waterslide. Juvenile fish are safely passed over the weir more efficiently than with conventional spill while reducing migration delays at the dam. To maintain the original capacity of the spillways for flood passage, the structure is also designed to be "removable" by controlled descent to the bottom of the dam forebay.

A second spillway weir was installed at Ice Harbor Lock and Dam (Ice Harbor) in 2005, and a third is being installed at Lower Monumental Lock and Dam (Lower Monumental) this year.



The weir at Little Goose is substantially similar to other RSWs fabricated and installed at other Lower Snake River multi-purpose dams. Site adaptations to support the structure will be required because the geometry and configuration of the dams are different.

A unique feature of this weir will be an adjustable crest, allowing flow to be adjusted between two operating ranges. The RSW crest may be adjusted to either of two positions. The crest in the elevated position is at elevation 621 feet; the crest in the lowered position is at elevation 618 feet. The crest leaf is attached to the main RSW structure through five hinges near the downstream edge of the leaf. These hinges are designed to carry the required proportion of the hydraulic load and transfer it to the RSW structure. The crest is designed to be raised while the RSW is in the deployed position but not while the RSW is passing water. So, the flow must be stopped by the spillway tainter gates. The crest lifting mechanism is a pair of screw jacks at either end of the leaf.

Little Goose RSW

To complete the system in the Lower Snake River, a fourth RSW is being planned for installation and operation at Little Goose in 2009.

The weir will be retrofitted into spillway bay 1 at Little Goose. Like the other weirs, the structure is designed to be "removable" by controlled descent upstream and downward rotation to the bottom of the dam reservoir. The structure is designed similar to a

submarine, allowing air to be added to ballast tanks to raise the massive structure to the upright operating position after the flood event. The massive device weighs approximately 2 million pounds, and is 130 feet tall, 78 feet wide, and 70 feet deep in the upstream to downstream dimension.

Prior related contracts for the construction and installation of RSWs include:
Contract DACW68-00-C-0060, Lower Granite Prototype Removable Spillway Weir.
Contract W912EF-04-C-0020, Ice Harbor Removable Spillway Weir.
Contract W912EF-06-C-0019, Lower Monumental Removable Spillway Weir.

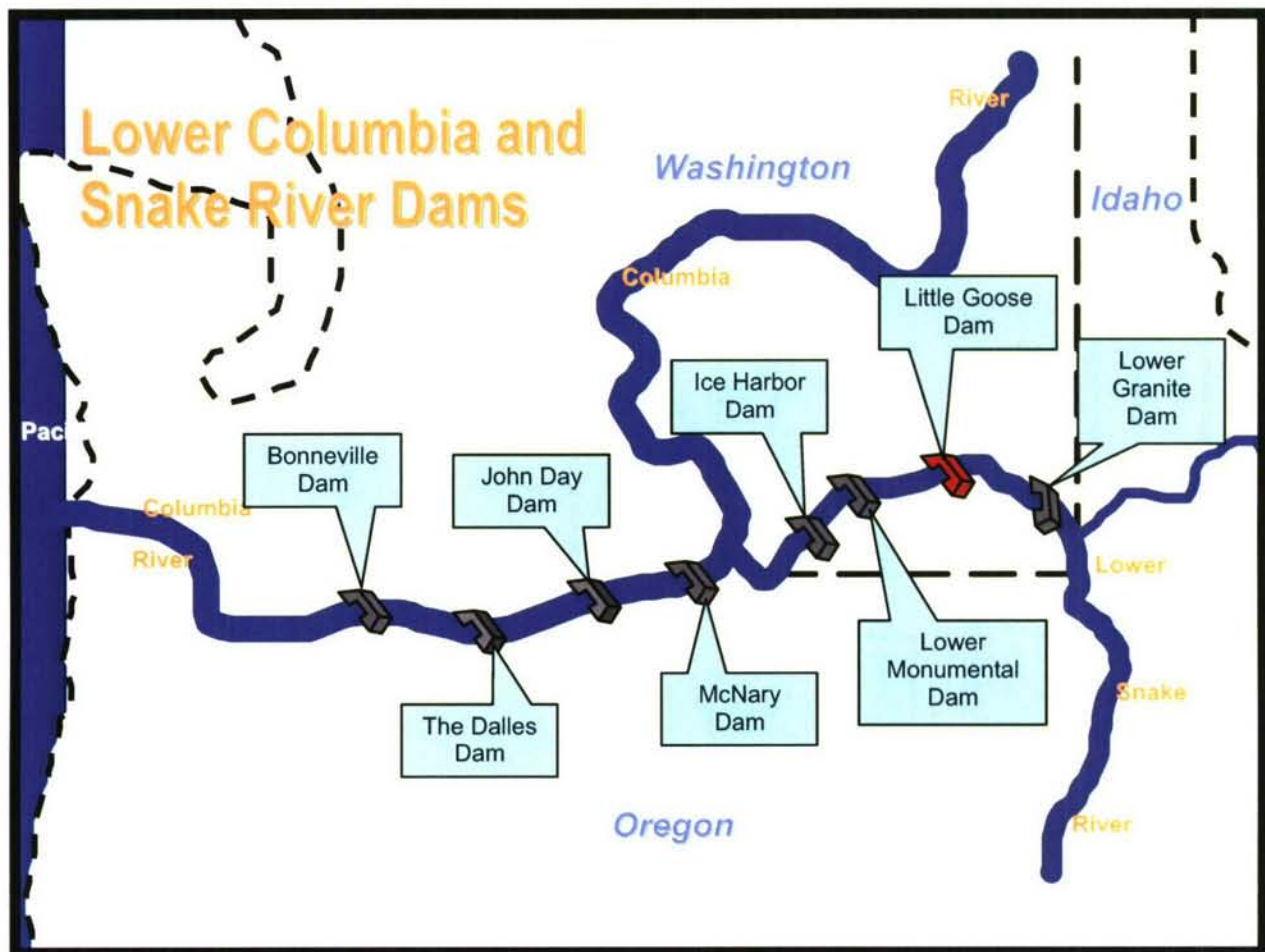
The Lower Granite contract was a construction contract issued as an Invitation for Bids (IFB). The Ice Harbor and Lower Monumental contract were construction contracts issued as a Request For Proposal (RFP), Lowest Price Technically Acceptable (LPTA). The present acquisition strategy for the Little Goose RSW is RFP, LPTA.

The work to be performed under this hybrid supply and construction contract is all necessary labor, materials, supplies, and equipment required for a complete and operable RSW. The RSW is a floating structural steel fabrication which will be attached to the dam at spillway bay 1, the southern most spillway bay at Little Goose. The work will include:

- Structural steel fabrication
- Services of Naval Architect and Marine Surveyor for RSW transport
- High performance submersible coatings on all steel, inside and out.
- Underwater cast-in-place concrete placement – approximately 150 cubic yards
- Excavation of the river bottom and placement of crushed rock
- Underwater diving to depths of 120 feet to support installation activities
- Surveying of the spillway, piers, and river bottom adjacent to the spillway bay
- Water and air piping, valves, and appurtenances
- Two 13 inch bore, self-lubricating spherical bearings
- Air compressor systems

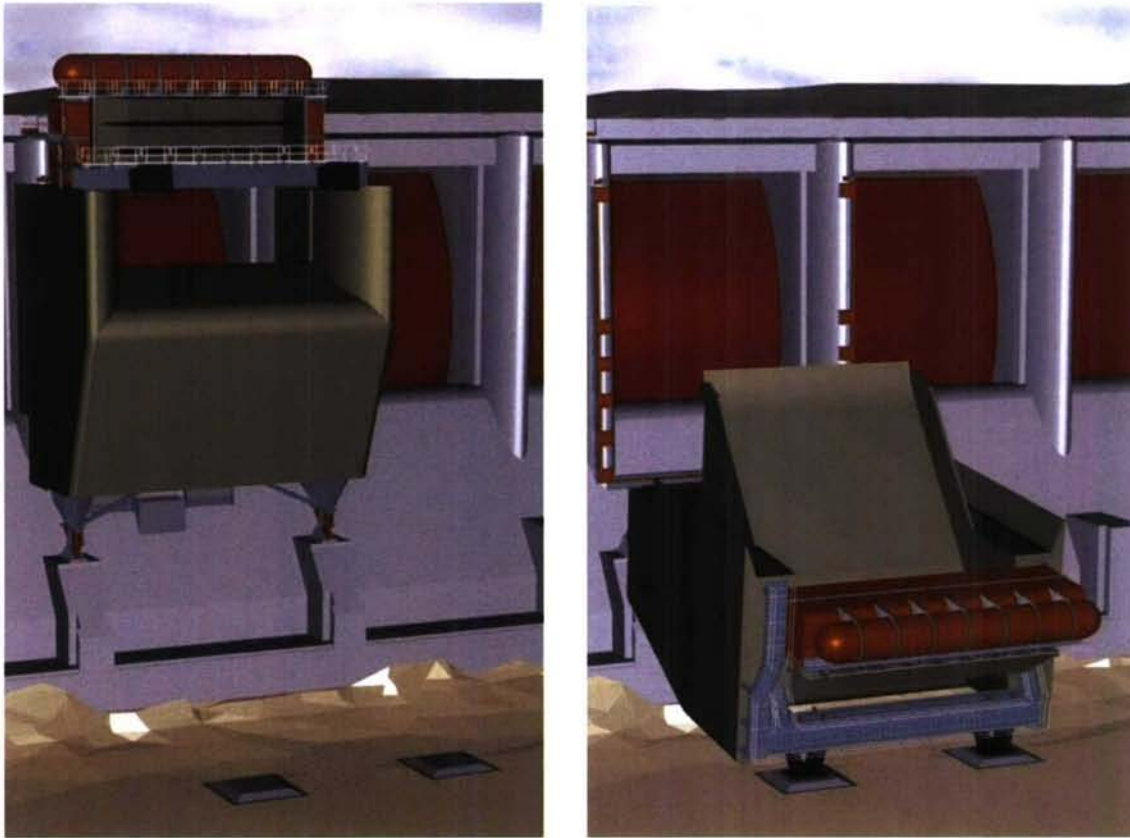
The total project cost is estimated to at an approximate \$15 million dollars for the fabrication and installations. The commissioning work to test operations (stow to river bottom and deploy to the raised position) will be conducted by the Government, with some on-site assistance (hourly) by the Contractor.

Vicinity Diagram

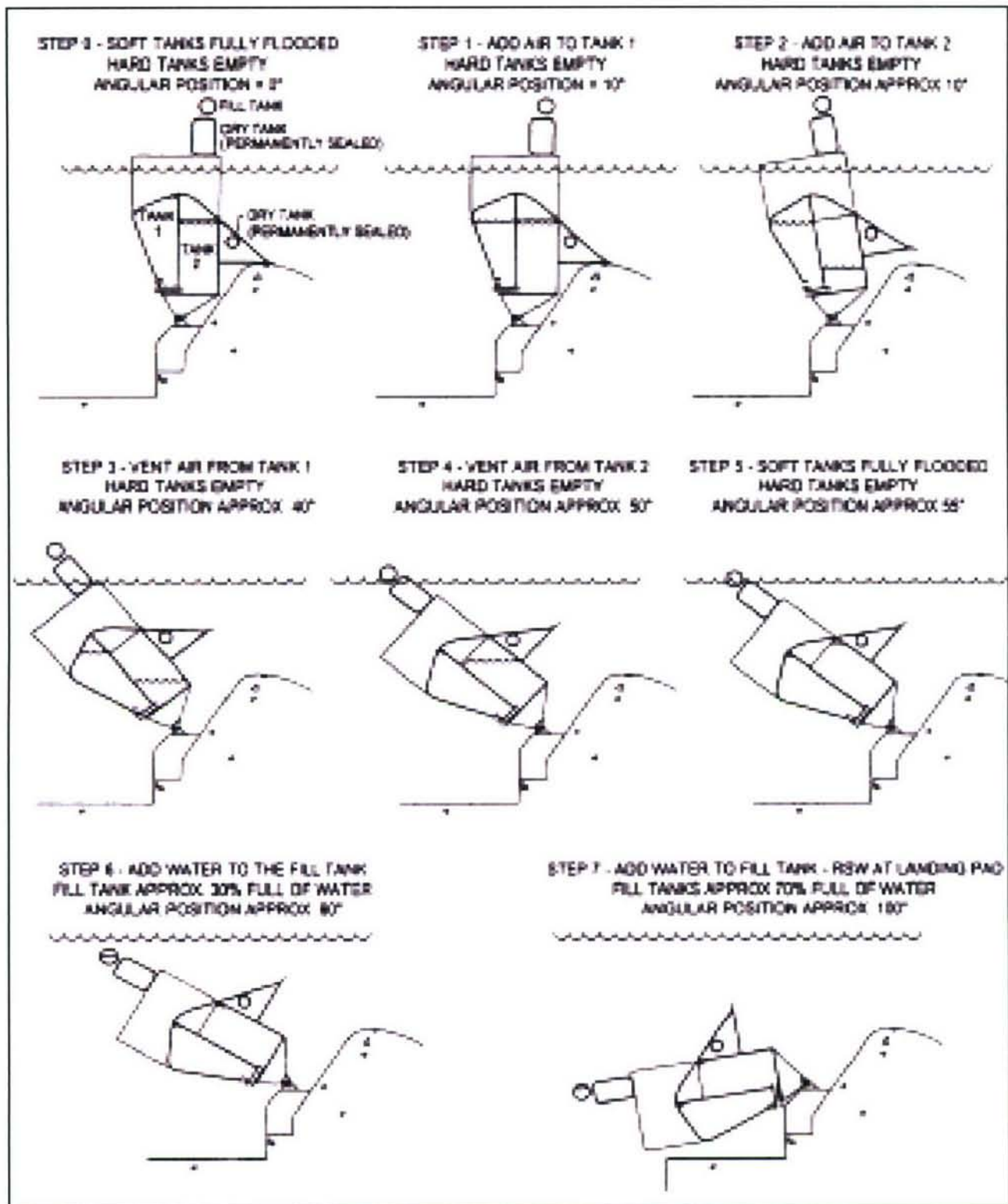


The Little Goose project is one of the four lower Snake River lock and dams. It is the third project in upstream order located 70.3 river miles upstream from the confluence with the Columbia River. The project includes a powerhouse with six turbine units, eight radial gate controlled spillway bays, a navigation lock, an earthen embankment, and an adult fish ladder with three main entrances. Little Goose is located near Starbuck, Washington.

RSW Operation/Deployment



The RSW is hinged to the dam so it follows a predictable path and to simplify control of the RSW during the descent/deploy process. When the RSW is to be rotated away, it is unlatched from the dam and rotated away and down until it rests on a landing pad at the bottom of the forebay. The movement is initiated and controlled by adding or releasing air and water to adjust the RSW ballast.



The ballasted descent system planned for the Little Goose RSW is similar to the system installed at Ice Harbor and designed for Lower Monumental.

The tanks that will be used to control the underwater rotation are "hard tanks" that are not open to the surrounding water pressure. This means the buoyancy of the tank will remain constant, because the air bubble is not compressed regardless of the RSW operating depth. It comes at the cost of greater structural weight because the loads on the structure increase with depth. "Soft tanks" will be used to begin the initial rotation of the vertical RSW over the centerline of the hinge. The hard tanks are sized so that the RSW floats with part of the structure out of the water when the soft tanks are completely vented and full of water. The "soft tanks" are not used during the submergence phase in order to eliminate control problems arising from gas volume compression in these tanks as the RSW sinks. To fully submerge the structure, water will be added to the hard tanks to make the structure heavy enough to sink. At the end of the storage procedure, when the RSW is lying on the riverbed, both "hard tanks" will be completely filled with water in order to ensure the structure is firmly anchored to the ground. The hard tanks are the upper two tanks, one round, and one rectangular. The two lower tanks are soft tanks.

The RSW rotates downward through a series of stable steps. It will only move downward when water is actively introduced to reduce buoyancy. When no water is introduced, the RSW will come to a stop at a stable position where it will remain until more water is added. Note that if the center of buoyancy (COB) and center of gravity (COG) positions are reversed so that the offset angle to the COB is upstream, the opposite affect occurs and the RSW will accelerate as it rotates unless adding air increases the buoyancy of the hard tank.

This simplifies control because the control system does not have to guard against a runaway descent. It only needs to control the addition of water so buoyancy is reduced at a controlled rate to maintain a safe descent. If an over-speed condition is encountered, cutting off the water supply will automatically engage the "braking action" inherent in this layout of the RSW. Similarly, in the event of an equipment or power failure, the RSW will stop at a stable position, without intervention, until the fault is repaired.

Value Engineering Proposals

VE-1 INCLUDE PAINT COATING OPTION OTHER THAN VINYL FOR EXTERIOR (EXCEPT FOR ZONE 3)

ORIGINAL DESIGN:

The coating system specified for the exterior of the RSW (Zone 2 and Zone 3) requires vinyl paint coating system exclusively. This is the only option that is allowed in the specifications.

PROPOSED DESIGN:

Prior specifications allowed several options. For the high velocity areas (Zone 3) the options were; 1) Vinyl, 2) Ultra High Solids epoxy, and 3) Polyurea systems. For the low velocity areas (Zone 2), the same systems were allowed and additionally; 4) moisture cure urethane, and 5) coal tar epoxy systems were allowed. Provide the same schedule of coating systems as allowed in the previous RSW contract. While the vinyl coating system is a desirable system, local jurisdictions and fabrication policies for VOC releases may exclude or restrict the application of vinyl. This would potentially increase the bid prices substantially or cause an expensive modification at a later date. The proposed design would allow additional coating options for Zone 2, low velocity areas and Zone 3, high velocity areas.

COSTS:

Costs are based on data provided by NWW Cost Engineering Branch. The difference between vinyl paint systems and the lower cost moisture cure urethane paints as recommended S&S coatings of Spokane, Washington, is approximately \$50.7 thousand. See appendix A for correspondence on this issue.

ADVANTAGES:

- Will not restrict bidders where environmental regulations do not permit high volatile organic compound (VOC) paints to be used.
- Avoid possible modification of contract after awarded to change the coating system to a paint that meets local environmental regulations.
- Reduce the costs associated with application of vinyl paint due to the many coats and cleaning between coats that are required to achieve the minimum paint thickness.
- Atmosphere conditioning (dehumidification/heat) only needs to be maintained during abrasive blasting. Once the prime coat is applied, only humidity is required to cure moisture cure paints. There is lots of that in Portland in December-February.

DISADVANTAGES:

- Moisture cures and epoxies have not proven to be as durable and repairable as vinyl systems.

JUSTIFICATION:

Using the same coating systems as the previous RSW contracts has proven to provide enough options that bidders are able to be compliant with local environmental regulations. Costs are reduced because atmospheric conditioning is not required during all coats of paint being applied. Labor man hours are reduced due to fewer coats (3 versus 6 coats) being applied.

VE-2 ELIMINATE RADIOGRAPHIC WELD TESTING EXCEPT FOR FRACTURE-CRITICAL MEMBERS

ORIGINAL DESIGN:

The design currently requires radiographic and ultrasonic testing of all full penetration groove welds which are further defined as structural butt welds.

PROPOSED DESIGN:

Eliminate all radiographic testing of structural butt welds with the exception of those welds in members designated as fracture critical. Radiographic inspection would still be required for all structural butt welds in fracture critical members in accordance with American Welding Society (AWS) D1.5.

ADVANTAGES:

- Shorter testing durations allowing maximum fabrication time.
- Lower cost to the Government with little or no reduction in quality requirements.

DISADVANTAGES:

- None noted since the more stringent testing would be retained for fracture critical members.

JUSTIFICATION:

The fabrication of the RSW requires that the fabricator work multiple shifts and weekends to meet the schedule. Radiographic inspection requires all personnel to clear the area due to potential health risks. Therefore during radiographic inspection periods, no work can be performed in the immediate vicinity. There are literally thousands of

feet of structural butt weld to be tested on the RSW. Reducing the amount of radiographic testing significantly decreases the schedule risk associated with this project. The use of ultrasonic weld inspection will provide the Government with a quality product at lower cost. Radiographic inspection would be retained in the most critical members.

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| CONSTRUCTION COST ESTIMATE | | | DATE PREPARED | | 19-Jun-07 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Little Goose RSW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Little Goose | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VE-2 Eliminate RT weld testing on full pen groove welds | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Background and Assumptions | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Original specification calls for RT(xray) and UT of structural butt welds. Proposed change is to just UT the welds and delete RT requirement. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| <table><tr><td>DESCRIPTION</td><td>QTY</td><td>U/M</td><td>HRS EXT</td><td>LABOR RATE</td><td>LABOR COST</td><td>MAT'L U/P</td><td>MAT'L COST</td><td>TOTAL</td></tr></table> | | | | | | | | | DESCRIPTION | QTY | U/M | HRS EXT | LABOR RATE | LABOR COST | MAT'L U/P | MAT'L COST | TOTAL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| DELETED WORK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table><tr><td>RT TESTING</td><td>5400</td><td>LF</td><td>450.00</td><td>\$ 121.00 /hr</td><td>\$54,450.00</td><td>\$3.43</td><td>18,522.00</td><td>72,972.00</td></tr><tr><td colspan="9">productivity of 12 lf/hr</td></tr><tr><td colspan="9">2 men at \$55/hr rate with 10% third shift differential</td></tr><tr><td colspan="9">working 8 hour shifts</td></tr><tr><td colspan="9">7x17 AFGA film \$3.43 assume 12" coverage with overlap</td></tr><tr><td colspan="9"></td></tr><tr><td>RT TESTING HANDLING</td><td>5400</td><td>SHEETS</td><td>72.00</td><td>\$ 55.00 /hr</td><td>\$3,960.00</td><td>\$0.15</td><td>810.00</td><td>4,770.00</td></tr><tr><td colspan="9">assume 75 sheets/hr to develop, index and catalog, \$0.15/sheet for developing materials</td></tr><tr><td colspan="9"></td></tr><tr><td>RT TESTING REVIEW</td><td>5400</td><td>SHEETS</td><td>45.00</td><td>\$ 55.00 /hr</td><td>\$2,475.00</td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td>TAX</td><td>8.10%</td><td>\$1,565.89</td></tr><tr><td colspan="5">TOTALS</td><td>\$58,410.00</td><td></td><td>19,332.00</td><td>79,307.89</td></tr><tr><td colspan="9"></td></tr><tr><td colspan="9"></td></tr></table> | | | | | | | | | RT TESTING | 5400 | LF | 450.00 | \$ 121.00 /hr | \$54,450.00 | \$3.43 | 18,522.00 | 72,972.00 | productivity of 12 lf/hr | | | | | | | | | 2 men at \$55/hr rate with 10% third shift differential | | | | | | | | | working 8 hour shifts | | | | | | | | | 7x17 AFGA film \$3.43 assume 12" coverage with overlap | | | | | | | | | | | | | | | | | | RT TESTING HANDLING | 5400 | SHEETS | 72.00 | \$ 55.00 /hr | \$3,960.00 | \$0.15 | 810.00 | 4,770.00 | assume 75 sheets/hr to develop, index and catalog, \$0.15/sheet for developing materials | | | | | | | | | | | | | | | | | | RT TESTING REVIEW | 5400 | SHEETS | 45.00 | \$ 55.00 /hr | \$2,475.00 | | | | | | | | | | TAX | 8.10% | \$1,565.89 | TOTALS | | | | | \$58,410.00 | | 19,332.00 | 79,307.89 | | | | | | | | | | | | | | | | | | |
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| productivity of 12 lf/hr | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 men at \$55/hr rate with 10% third shift differential | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| working 8 hour shifts | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7x17 AFGA film \$3.43 assume 12" coverage with overlap | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| RT TESTING HANDLING | 5400 | SHEETS | 72.00 | \$ 55.00 /hr | \$3,960.00 | \$0.15 | 810.00 | 4,770.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| assume 75 sheets/hr to develop, index and catalog, \$0.15/sheet for developing materials | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| RT TESTING REVIEW | 5400 | SHEETS | 45.00 | \$ 55.00 /hr | \$2,475.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| TOTALS | | | | | \$58,410.00 | | 19,332.00 | 79,307.89 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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VE-3 BOAT BARRIER

ORIGINAL DESIGN:

A boat barrier design associated with the Little Goose RSW has not yet been completed. However, this feature is currently shown as an optional item in the 60-percent plans and specifications package. Division 35 specifications call for a boat barrier system for Little Goose as associated with the RSW installation and is the same technical specification used recently for Ice Harbor. The current plan is to pattern the layout of the boat barrier concept after the recently awarded Ice Harbor RSW boat barrier design. The Ice Harbor boat barrier system, with a total length of about 1,600 feet, is aligned parallel to the dam and located about 900 feet upstream of the RSW. The system consists of a series of shallow draft floating drums connected by a cable arrangement held in place by a system of cables and anchors. It spans parallel to the dam and extends across the width of the river, excluding the navigation channel lane along the north shoreline and a small boat access gap near the south shoreline. Using the same layout criteria used at Ice Harbor, the boom at Little Goose would need to be approximately 2,000 feet long. See sketch "Alignment A" that illustrates the anticipated layout based on the recently awarded boat barrier at Ice Harbor.

PROPOSED DESIGN:

Little Goose installed a "debris boom" several years ago that helps to deflect debris away from the powerhouse. The intent of the debris boom was to reduce floating debris from accumulating upstream of the powerhouse and reduce the amount of material that frequently jammed the orifices in the fish collection system. The debris boom has very high capacity bottom anchors and cables, designed to be restrained under debris, wind, and wave loads. The boom system allows the opportunity to be an anchor point for the proposed boat barrier on the south end, versus having to install additional mass concrete anchors to the river bottom. The proposed design would connect the south end of the boat barrier boom at the mid-point of the existing trash-shear boom and would utilize an existing primary anchor to secure the south end of the boat barrier. The boat barrier boom would extend northwest (off-parallel to the dam) approximately 800 feet and would secure either to the river bottom or to the dam. See sketch "Alignment B" that illustrates the proposed layout.

ADVANTAGES:

- Significantly reduces barrier boom length and associated cables.
- Reduces number of mass anchors needed to be placed on the river bottom.

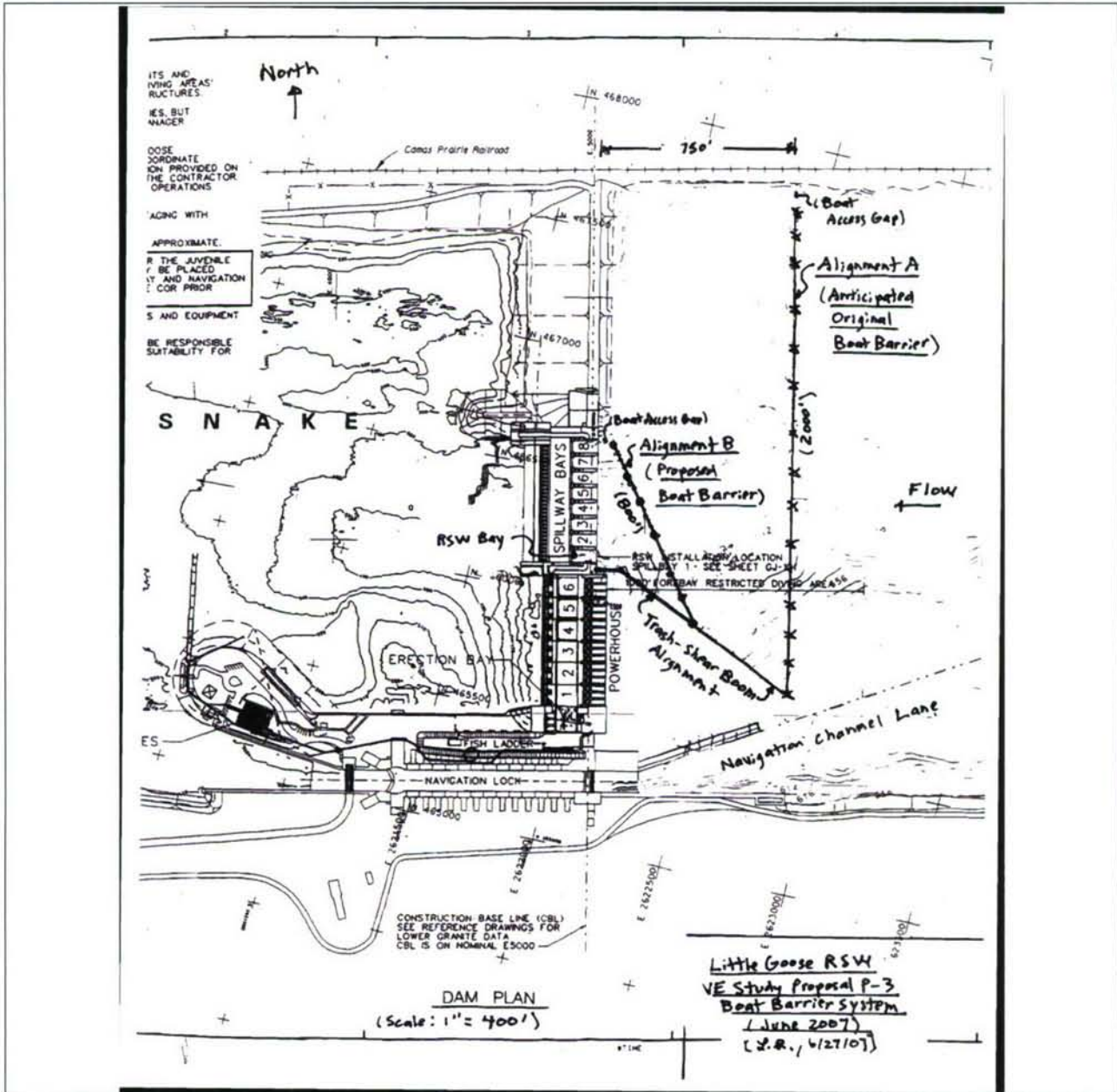
DISADVANTAGES:

- The boom will be located closer to the RSW (200-feet versus 750-feet), but for a shallow draft boom design, it should not have any negative impacts for the performance of the RSW/spillway as it relates to fish, debris, or other project related performance objectives.

JUSTIFICATION:

Construction installation and maintenance costs will be significantly lower.

SKETCH:



| COST ESTIMATE WORKSHEET | | | | |
|--|-------|----------|-----------|------------------|
| VE-3 Proposal - Revise Boat Barrier Design | | | | |
| Ice Harbor bid schedule - \$502,342 for 1600 lf of boom = \$314 per lf | | | | |
| DELETIONS | | | | |
| ITEM | UNITS | QUANTITY | UNIT COST | TOTAL |
| Reduce barrier length | LF | 1,200 | \$314.00 | \$376,800 |
| assumes reduction from 2000' to 800' | | | | \$0 |
| | | | | \$0 |
| reduce anchorage (furnish) | LF | 800 | \$72.00 | \$57,600 |
| assumes proportionate reduction from previous bid price | | | | \$0 |
| bid price was \$115,327/1600 = \$72/LF | | | | \$0 |
| | | | | \$0 |
| reduce installation costs | LF | 800 | \$224.00 | \$179,200 |
| assumes proportionate reduction from previous bid price | | | | \$0 |
| bid price was \$359,695/1600 = \$224/LF | | | | \$0 |
| | | | | \$0 |
| | | | | \$0 |
| Total Deletions | | | | \$613,600 |
| ADDITIONS | | | | |
| ITEM | UNITS | QUANTITY | UNIT COST | TOTAL |
| | | | | \$0 |
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| | | | | \$0 |
| Total Additions | | | | \$0 |
| Net Cost Decrease | | | | \$613,600 |
| note: assumes mark-ups already included in bid price | | Mark-ups | 0.00% | \$0 |
| Total Cost Decrease | | | | \$613,600 |

COST SAVINGS:

Note: Actual instant cost savings will be determined at award of the Little Goose RSW contract by comparison to the Ice Harbor barrier contract.

VE-4 CHANGE COMPRESSOR TO BLOWER

This proposal was initially considered viable, but was later dropped from consideration because the RSW pounds per square inch (psi) requirements could not be met with a blower system.

VE-5 USE MECHANICAL BANDED CONNECTION FOR PIPING RUNS

ORIGINAL DESIGN:

Stainless steel piping of various diameters is used for the air/water system. The piping used on the RSW has approximately 175 joints to be welded by Gas Tungsten Arc Weld (GTAW) process. Stainless steel piping is also used on the Pier face. The GTAW process is a labor intensive welding process. Many of the welds must be made in places that are out of position and difficult to reach which requires many man hours.

PROPOSED DESIGN:

Use compression fittings (i.e., Viega Sanpress Inox XL or similar on pipe joints) where applicable in lieu of welding joints by GTAW process. The piping and fittings have a 200 psi rating. The fittings include tee, elbows couplings, unions, and valves. Fitting are crimped on using a press-fitting machine. This machine is designed for use in difficult to get places. Compression fittings may not be able to be use for all weld joints, but can be used in conjunction with GTAW.

ADVANTAGES:

- Reduce the welding man hours of pipe joints.
- Tubing can be GTAW as necessary through bulkhead penetrations and adapt to most valves/components.
- Coast Guard (CG) and American Bureau of Shipping (ABS) approved.

DISADVANTAGES:

- Thin wall tubing may need to be protected.
- May not work with all system components.
- Possibly does not meet American Society of Mechanical Engineers (ASME) requirement for pressure vessel pipe welding.

JUSTIFICATION:

Using this system would minimize the intense shop lay out, pre fit, weld, and final field fit up, install and weld. The air/water piping is installed in the final outfitting of the RSW after paint and prior to launch. It would help with the contractors schedule if this time

could be shortened. The field work uses 7 men, 40-50 hour per week for 5 weeks to fit, weld, and test. Shop pre-fit up and welding hours not included.

Pipe 2-1/2 inch and smaller requires 2 weld passes minimum

Shop welding = 1 hour per joint

Field welding = 1-1/2 – 2 hours

Pipe larger than 2-1/2 inch requires 3 weld passes minimum

Shop weld = 1-1/2 hours per joint

Field weld = 2 plus hours per joint

Compression fittings, shop and field = 20 minutes or less

Welding hours are estimates. Weather, position difficulty, access, and experience may add to these hours.

RECOMMENDATION:

This proposal should be revised to a comment to allow consideration of banded connections where accessibility to the joints warrants. This may reduce the overall number of expensive welded connections. To ensure quality of connections in underwater locations, welded joints as currently designed are recommended as the system reliability and access to joints underwater area concern.

VE-6 USE ALTERNATE MATERIAL FOR SEAL PLATE EMBEDS (STAINLESS TO CLAD PLATE)

This proposal was initially considered viable, but was later dropped from consideration due to material availability.

ORIGINAL DESIGN:

Bearing plates are fabricated and machined using 3-3/4 inch stainless steel plates. Plate dimensions are approximately 2 each at 3'-6" x 5'-6", 10 each at 3'-0" x 3'-4", and 2 each at 1'-0" x 3'-4". Total of 14 plates.

PROPOSED DESIGN:

Use carbon steel plates with a stainless steel cladding overlay.

ADVANTAGE:

- Cost reduction

DISADVANTAGE:

- Not available as a production item. Special manufacturing required.

JUSTIFICATION:

Further investigation found that carbon steel plate clad with stainless steel is not available in 3-3/4 inch plate. Special manufacturing could possibly be done but the expense would exceed stainless steel plate cost and there would be no quality improvements benefit.

Value Engineering Comments

Comments to Design Team for Consideration:

C-1. Consider feasibility of new coating technologies (rhino liner, etc.) for future hydraulic structure coatings. Applications for fish passage devices and or other hydraulic structures subject to wind/wave and debris damage may benefit from new coating technologies.

C-2. Evaluate necessity of the number of eyes/connectors and frame for biological monitoring and testing equipment. Re-examine the methodology/number/location of biological monitoring equipment requirements for the RSW in light of lessons learned from previous RSW installations and on new projected research needs for the future. The current design is patterned off the Ice Harbor RSW design, and the biological monitoring requirements may have changed (increased or decreased) over time. This may affect not only the number of eyes/connectors points and biological equipment framing support needs, but might also affect cord routing provisions from the RSW to equipment located on the deck.

C-3. Evaluate construction of anchor tank. Investigate if more a simplified structure can be designed for future pressure vessels.

C-4. Consider use of alternate materials for spillway bay concrete repair (versus shotcrete).

C-5. See VE-5 recommendation. To ensure quality of connections in underwater locations, welded joints as currently designed are recommended as the system reliability and access to joints underwater area concern. Consider use of banded connections where accessibility to the joints warrants. This may reduce the overall number of expensive welded connections

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APPENDIX A

SUPPORTING DOCUMENTATION

Appendix A – Supporting Documentation

VE-1

-----Original Message-----

From: Rick Gilbreath [<mailto:sherwinwilliamsak@yahoo.com>]

Sent: Wednesday, July 11, 2007 8:47 AM

To: Mark Schultz

Subject: Re: FW: RSW Paint Coating Estimates

Mark, using the NACE Corrosion guide in a moderate industrial atmospheric situation, the following timelines are issued. I have also attached this document for your review.

Keep in mind the service life in years is associated with 5-10% loss of coating.

Vinyl System 1: No testing done, If I had to guess it would be about half the life of the Epoxy or 8.5 years

Coal Tar System 2: This test was done with only 2 coats w/out the Zinc....17 years

Epoxy System 3: 3 coats of epoxy.....17 years

MCU System 4: 1 coat mcu zinc/2 coats mcu urethane.....21 years

Please call with any questions.

Thanks,
Rick

Rick Gilbreath
The Sherwin-Williams Company
Industrial Coatings Specialist
NACE CIP #10542
3200 E Trent Ave. Ste C Bldg 2
Spokane, WA 99202
Voice/Message: (509) 979-5555

-----Original Message-----

From: Neubauer, James G NWW

Sent: Tuesday, July 10, 2007 1:25 PM

To: Bender, Carl C NWW

Cc: Crum, Kevin E NWW

Subject: RSW Paint Systems

Carl/Kevin: Based on 58,000 sf of Zone 2 painting, supported by cost quotes from S&S Coatings, we compute:

| | |
|-----------------|----------|
| Vinyl Paint: | \$211.4K |
| Coal Tar Epoxy: | \$190.3K |
| UHS Epoxy: | \$224.1K |
| MC Urethane: | \$160.7K |

Note that this cost study does not consider life cycle nor paint application duration in support of an aggressive fabrication schedule.

Jim N

-----Original Message-----

From: Mark Schultz [<mailto:Marks@s-scoatings.com>]

Sent: Monday, July 09, 2007 8:43 AM

To: Neubauer, James G NWW

Cc: Crum, Kevin E NWW

Subject: RE: RSW Paint Coating Estimates

Gentlemen,

Please see below comments re. RSW Paint Systems.

Thanks,

Mark Schultz

S&S Coatings, Inc.

From: Neubauer, James G NWW [<mailto:James.G.Neubauer@nww01.usace.army.mil>]

Sent: Friday, July 06, 2007 12:41 PM

To: Mark Schultz

Cc: Crum, Kevin E NWW

Subject: RSW Paint Coating Estimates

Mark: In discussions with Kevin Crum, we have revised our list of paint coating alternatives. We are now looking at paint coating alternatives for 58,000 sf of exterior RSW. The paint systems considered are:

1) Vinyl system No. 4 (5 coats totaling 7.5 - 8 mil)

Cost/sq.ft.=\$2.50. Relatively inexpensive material @ \$15/gal, however, VOC requirements (depending on geographics) limit ability to apply w/o proper EPA approved filtration equipment. Vinyl systems require optimal application conditions as well. Containment of RSW an absolute must, even for spot touch-up after substantial completion of entire paint system.

2) Coal Tar epoxy System 6-A-Z (2 layers of zinc-rich primer plus 2 coats of coal tar epoxy totaling 16 mil)

Cost/sq.ft.=\$2.25. Zinc materials are very expensive. 2-coats of Zinc (as described above) seems excessive. 1-coat Zinc/2-coats coal tar is much more common, even for submersion surface(s). Cost for this system would be \$1.75/sq.ft. Coal Tar epoxies would result in a fairly significant material loss as it is a catalyzed material. Also, epoxies require heat to cure, which could result in down-time if containment is not heated properly (wait for cure).

3) UHS Epoxy System RSW-3 (1 coat primer, 1 coat UHS epoxy white, 1 coat UHS epoxy grey-green totaling 23 mil)

Cost/sq.ft.=\$2.65. Very difficult material to work with. Need specialized equipment. Conditions inside containment need to be optimal. Substantial material loss due to rapid cure time. Increased millage a definite benefit in submersion service.

4) Moisture cure urethane RSW-1 (1 coat MC zinc-rich primer, 2 coats MC urethane totaling 14 mil)

Cost/sq.ft.=\$1.90. Easy material to work with. Application conditions need not be perfect. Cures in moist, cool weather. Hot, dry weather makes the material a little trickier to work with. Material is fairly inexpensive.

Note: All cost/sq ft are for paint application, material, solvent, and sundries required for the painting process only. I have assumed that surface preparation will be consistent with each and every RSW System (SP10, full field blast). I have not allowed for containment, surface preparation, materials, fuel, equipment, or the like, as they relate to surface prep, in the above sq ft. costs. If you would like costs associated with these tasks, please advise and I can provide.

My recommendation would be the MCU system. The flexibility these materials provide will allow for marginal weather application(s). As you will recall, all of the above systems were allowable for application on the previous RSW's. I believe the MCU system was used on all 3 RSW's currently installed (or in process of being installed).

Please advise if you would require additional information.

I am out of the office until 10 July. If you could please provide the above information by COB 9 July, we would very greatly appreciate it (We know this request is a favor under no obligation).

Jim N
509-520-2518

-----Original Message-----

From: Neubauer, James G NWW
Sent: Friday, July 06, 2007 12:41 PM
To: 'marks@s-scoatings.com'
Cc: Crum, Kevin E NWW
Subject: RSW Paint Coating Estimates

Mark: In discussions with Kevin Crum, we have revised our list of paint coating alternatives. We are now looking at paint coating alternatives for 58,000 sf of exterior RSW. The paint systems considered are:

- 1) Vinyl system No. 4 (5 coats totaling 7.5 - 8 mil)
- 2) Coal Tar epoxy System 6-A-Z (2 layers of zinc-rich primer plus 2 coats of coal tar epoxy totaling 16 mil)
- 3) UHS Epoxy System RSW-3 (1 coat primer, 1 coat UHS epoxy white, 1 coat UHS epoxy grey-green totaling 23 mil)
- 4) Moisture cure urethane RSW-1 (1 coat MC zinc-rich primer, 2 coats MC urethane totaling 14 mil)

I am out of the office until 10 July. If you could please provide the above information by COB 9 July, we would very greatly appreciate it (We know this request is a favor under no obligation).

Jim N
509-520-2518

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APPENDIX B

CONTACT DIRECTORY

Appendix B – Contact Directory

| <u>NAME</u> | <u>ORGANIZATION</u> | <u>TELEPHONE</u> | <u>EMAIL</u> |
|-----------------|----------------------|------------------|--|
| Richard Amacher | Portland District | 503-808-4432 | Richard.L.Amacher@usace.army.mil |
| Steve Sipe | Portland District | 503-808-4957 | Steven.C.Sipe@usace.army.mil |
| Paul Muller | Kansas City District | 816-389-3614 | Paul.D.Muller@usace.army.mil |
| Duane West | Walla Walla District | 509-527-7078 | Duane.A.West@usace.army.mil |
| Lynn Reese | Walla Walla District | 509-527-7531 | Lynn.A.Reese@usace.army.mil |

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APPENDIX C

SPECULATION AND ANALYSIS LIST

Appendix C – Speculation and Analysis List

NG = No-Go – Proposal dropped from further consideration during analysis
P = Proposal considered for further development as a VE recommendation
C = Comment to Design team

| No. | Act | Description | Lead | Notes |
|-----|---------------|---|-----------|--|
| 1 | NG-1 | High Discharge RSW w/dewatering/turbine | | |
| 2 | NG-2 | Using standard T-shapes for stiffeners. | | (Bulkhead schedule on the structural drawings already uses standard T-shapes where applicable, therefore this was considered implemented already) |
| 3 | NG-3 | Closure Device Modification Attached to RSW, Pre-cast (Build on surface) | | Consulted with designer, idea was dropped. The existing design seemed simple and reliable already. |
| 4 | P-1 (VE-1) | Include paint coating option other than vinyl for exterior (except for slide) | C. Bender | Cost to review past Lower Granite, Ice Harbor, Lower Monumental paint systems (zone 2 and 3) – price per square foot. Compare vinyl paint to moisture cure coal tar urethane (S/W). (Everything exterior except the slide area). |
| 5 | C-1 | Coat with polymer – Investigate new coating technologies, rhino liner, etc, for feasibility. Pass on as a comment if viable. | S. Sipe | Included as a comment |
| 6 | P-2 (VE-2) | Eliminate radiographic weld testing except for fracture-critical members | D. West | Review recent modification calculations to get quantity/costs |
| 7 | NG-4 | Expand schedule to reduce overtime. Eliminated due to actual project delivery date constraints/mandates. | | |
| 8 | P-3 (VE-3) | Incorporate the design of the boat barrier with the trash boom/RSW. Reduce cost of eliminating south end mass concrete anchor since this would be either fixed to the new trash boom frame or the existing trash boom intermediate float and cost of a shorter boat barrier (approximately 200 feet long versus 1,600 feet long). | L. Reese | Consulted with M. Summers, boat barrier could be attached to the T/S boom, need to investigate other impacts for fish. May be feasible to tie to an intermediate anchor on the T/S boom. |

| No. | Act | Description | Lead | Notes |
|-----|--|--|---------------------|---|
| 9 | NG-5 | Eliminate impact truss/incorporate fenders into pier extension - Replace the truss w/strut or tie. Keep same elevation on fenders. | | Structural was consulted, idea is technically feasible. Not sure if truss can be eliminated for other reasons, shipping, support for piers, possibly less substantial structure could be used, keep all other functions such as access walkways. Reduction in truss could affect the traditional use of the truss during transport. |
| 10 | NG-6 | Reduce bearing point and landing pad to single point (2 down to 1) Heavier truss, 3 bearing points, | | Structural was consulted; two fenders systems are needed because of loads cannot be handled by one fender system. Also, one load point would cause truss design to be increased and associated increase in costs for the truss. |
| 11 | P-4 (VE-4) | Potentially replace compressor with blowers - Verify costs and scope with Steve Sipe. Check lifecycle costs, do they last? | P. Auth | Mechanical determined the blower system was not adequate to generate pounds per square inch needed for RSW air supply. Proposal dropped from consideration for that reason. |
| 12 | NG-7 | Submersible blower mounted on/in RSW | S. Sipe | |
| 13 | NG-8 | Mount submersible compressor on RSW | S. Sipe | |
| 14 | NG-9 | Modify hose connection system to eliminate piping on dam face. | | Consulted with Mechanical - general opinion is that cost savings will not be substantial. |
| 15 | P-5 (VE-5) Changed to VE comment C-5 | Use mechanical banded connection for piping runs. | S. Sipe/ P. Auth | Designer will talk to mechanical vendor to verify ratings/capacity. Comment C-5, consider partial implementation where practical application can be made. |
| 16 | C-2 | Evaluate necessity of the number of eyes/connectors and frame for testing equipment. | L. Reese | Included as a comment |
| 17 | NG-10 | Fix RSW and provide alternative passage route for 115 kcfs. | | |
| 18 | NG-11 | Assemble at Little Goose or Lewiston rather than Portland | | |
| 19 | NG-12 | Lower the pool elevation during construction to reduce dive depths | | |
| 20 | C-3 | Evaluate construction of anchor tank. | P. Muller | Included as a comment. |

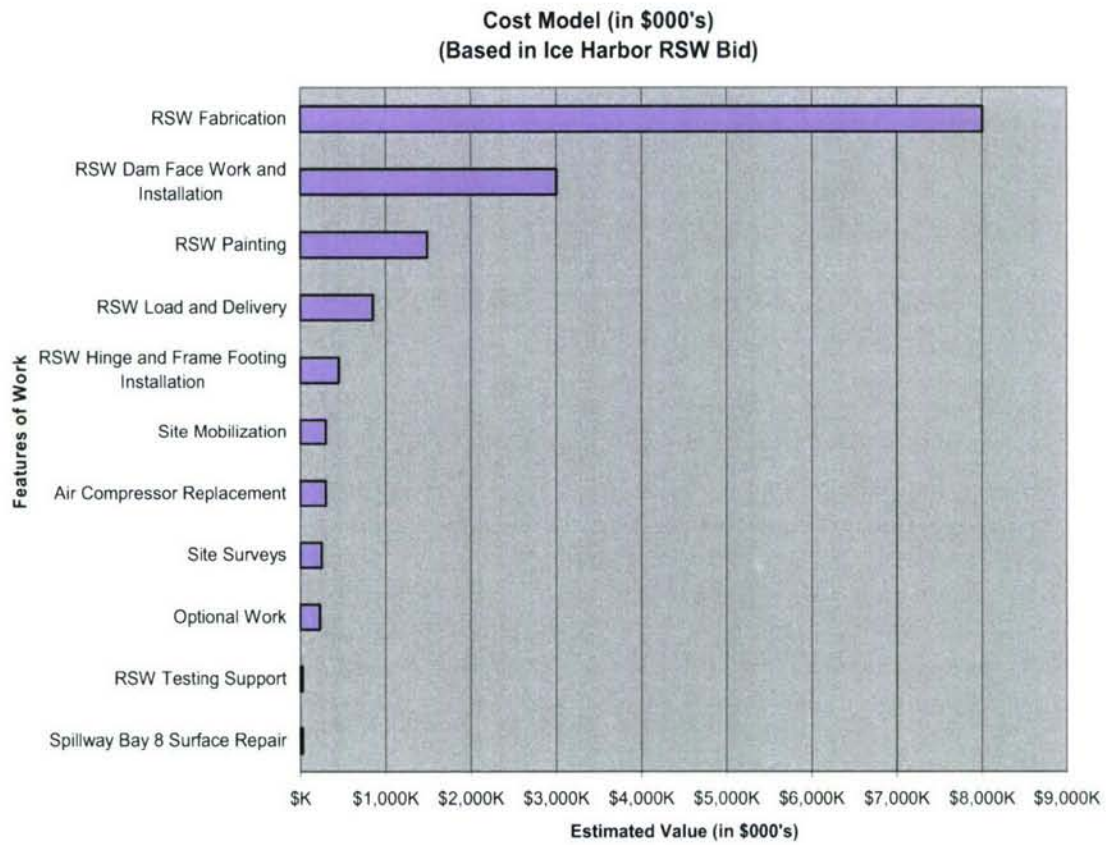
| No. | Act | Description | Lead | Notes |
|-----|---------------|---|------------|--|
| | | Standard pressure vessel Change shape Cylindrical possible Evaluate welds | | |
| 21 | P-6 (VE-6) | Use alternate material for seal plate embeds (stainless to clad plate). Consider use of Stainless Steel cladding over carbon steel, instead of SS. Will investigate cost savings during development phase. Bender estimate cost of cladding thick bearing plates versus SS, sheets 302. Approximate 3 cubic feet per each plate, per 10 plates – approximate 75K savings. | R. Amacher | Considered as a proposal but dropped from consideration due to material availability |
| 22 | NG-13 | Vertical removal to clear spillbay | | |
| 23 | NG-14 | Submarine spillway (drive out of the way during the flood) or consider a hinged door approach. | | |
| 24 | C-4 | Use alternate concrete repair method on spillway (no shotcrete) | P. Muller | Included as a comment. |
| 25 | NG-15 | Eliminate forebay survey | | |

LITTLE GOOSE LOCK AND DAM
REMOVABLE SPILLWAY WEIR
VALUE ENGINEERING STUDY

APPENDIX D

COST MODEL

Appendix D – Pareto Diagram Cost Model

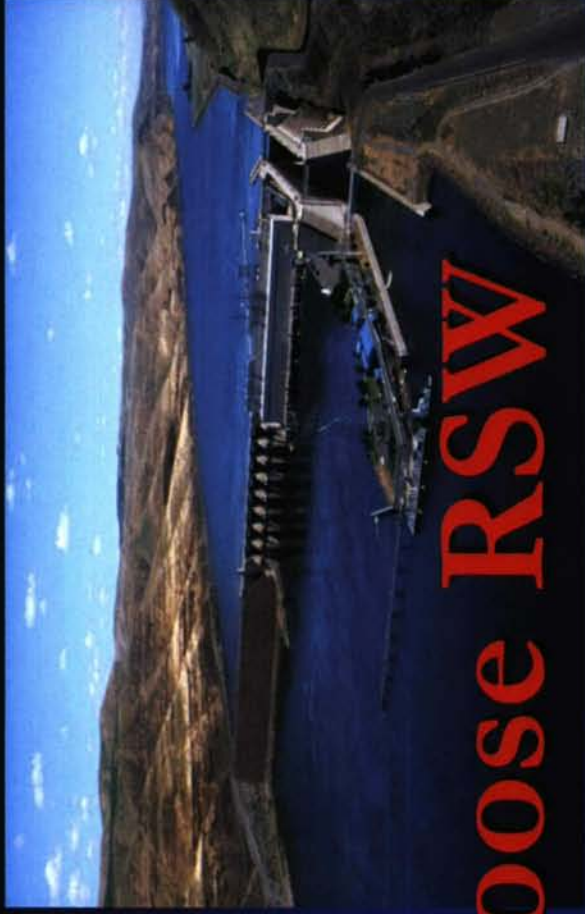


LITTLE GOOSE LOCK AND DAM
REMOVABLE SPILLWAY WEIR
VALUE ENGINEERING STUDY

APPENDIX E

PROPOSAL PRESENTATION
To Walla Walla District Design Team
July 19, 2007

Little Goose RSW



Value Engineering Proposals and
Presentation

July 19, 2007

Little Goose RSW - VE

- VE Team
 - Richard Amacher, NWP; Steven Sipe, NWP; Paul Muller, NWK; Lynn Reese, NWW; Duane West, NWW;
- VE Team Leader
 - Jack Sands, PM
- VEO
 - Kevin Crum

Little Goose RSW - VE

- The Value Engineering Study was conducted at the NWW on 12-14 June, 2007. The study was based 60% drawings and specifications dated May 29, 2007.
- The final report is being prepared in TIP for distribution to the design and VE team.
- Drafts are available today

Little Goose RSW – VE

Summary of Proposals

| Proposal | Subject | Instant Cost Savings | Status |
|----------|----------------------------------|-------------------------------------|-----------------|
| VE-1 | Paint Coating Options | \$50,700 | Recommended |
| VE-2 | Eliminate Radiographic Weld Test | \$107,123 | Recommended |
| VE-3 | Boat Containment Boom | \$613,600 <small>see note 1</small> | Recommended |
| VE-4 | Change from compressor to blower | \$0 | Dropped |
| VE-5 | Mechanical banded connections | \$unknown | See comment C-5 |
| VE-6 | Change from SST to Clad SS plate | \$0 | Dropped |

Total anticipated direct (instant) cost savings **\$ 771,423** see note 2

Note 1. Actual cost savings will be obtained at bid for items priced separately

Note 2. Additional Costs savings may apply for the Little Goose RSW design from prior VE studies (Ice Harbor and Lower Monumental RSW) if less than 6 years has elapsed for design proposals carried forward.

Little Goose RSW - VE

Proposal VE-1

VE-1 INCLUDE PAINT COATING OPTION OTHER THAN VINYL FOR EXTERIOR (EXCEPT FOR ZONE 3)

Original Design: The coating system specified for the exterior of the RSW (Zone 2 and Zone 3) requires vinyl paint coating system No. 4 exclusively. This is the only option that is allowed in the specifications at the 60% milestone.

Proposed Design: The proposed design would allow additional coating options for Zone 2, low velocity areas. This proposal calculates savings on Zone 2 only. Verify paint specifications whether to add paint options for high flow area Zones 3, such as metalizing and MCU.

Costs: Investigation of paint system indicate that system costs are similar, but when applied to large surface areas can become significant. Area calculated for Zone 2 is 58,000 sf. Total RSW surface area is approx 100,000 sf.

- **Vinyl** (system No. 4) costs approx \$2.50/sf.
- **Coal Tar Epoxy** (system 6-A-Z) costs approx \$2.25/sf - 2 coats zinc/ 2 coats epoxy.
- **UHS Epoxy** (system RSW-3) costs approx \$2.65/sf
- **Moisture Cure Urethane** (system RSW-1) costs approx \$1.90/sf - zinc rich primer and 2 coats MC urethane

Little Goose RSW - VE

Proposal VE-2

VE-2 ELIMINATE RADIOGRAPHIC WELD TESTING EXCEPT FOR FRACTURE-CRITICAL MEMBERS

Original Design: The design currently requires radiographic and ultrasonic testing of all full penetration groove welds which are further defined as structural butt welds.

Proposed Design: Eliminate all radiographic testing of structural butt welds with the exception of those welds in members designated as fracture critical. Radiographic inspection would still be required for all structural butt welds in fracture critical members in accordance with AWS D1.5.

Costs: Reduction of costs were achieved in a mod to the Lo Mo RSW. Estimated instant savings for elimination of unnecessary tests is approximately \$107K applied to the Goose RSW.

Little Goose RSW – VE

Proposal VE-3

VE-3 BOAT BARRIER

Original Design: The drawings for the Little Goose boat barrier were not completed at 60%. The VE study team assumed similar specs layout criteria used at Ice Harbor, resulting in a barrier approximately 2000 feet long.

Proposed Design: An existing debris boom at Little Goose offers additional anchor points for a boat barrier. If utilized, the boat barrier boom could extend northwest approximately 800 feet and would secure either to the river bottom or to the dam. This would substantially reduce the length of the barrier, cables and anchors while still providing the function.

Costs: Installation and maintenance costs would be reduced. Instant savings are estimated at \$613K. However, actual cost reduction would be identified at contract award from the bid item for the barrier system.

Proposal VE-3

BE RESPONSIBLE
SUITABILITY FOR



(Scale: 1" = 400')

Little Goose RSW
NE Study Proposal P-3
Boat Barrier System
(June 2007)
[2.R., 6/27/07]

Little Goose RSW - VE

Proposal VE-4

VE-4 CHANGE COMPRESSOR TO BLOWER

- This proposal was initially considered viable, but was later dropped from consideration because the RSW psi requirements could not be met with a blower system.

Little Goose RSW – VE

Proposal VE-5

VE-5 USE MECHANICAL BANDED CONNECTION FOR PIPING RUNS

Original Design: The piping used on the RSW has approximately 175 joints to be welded by Gas Tungsten Arc Weld (GTAW) process.

Proposed Design: Use compression fittings such as Viega Sanpress Inox XL or similar.

Status: This proposal has been changed to a comment (C-5). Designers should consider using banded mechanical connections where viable and where accessible. RSW supply lines connections are critical for operation and access to those lines will be difficult after RSW installation.

Little Goose RSW - VE

Proposal VE-5

Reliability in every dimension:
The stainless steel system -
Viega Sanpress Inox and Sanpress Inox XL.



E-11

viega

Little Goose RSW – VE

Proposal VE-6

VE-6 USE ALTERNATE MATERIAL FOR SEAL PLATE EMBEDS (STAINLESS TO CLAD)

Original Design: Bearing plates are fabricated and machined using 3-3/4 inch stainless steel plate. Plate dimensions are approximately 2ea @3'-6" x 5'-6", 10ea @3'-0" x 3'-4" and 2ea @ 1'0"x3'-4". Total of 14 plates.

Proposed Design: Use carbon steel plate with a stainless steel cladding overlay.
Potential savings approximately \$75K

Status: This proposal has been dropped due to availability. Further investigation found that carbon steel plate clad with stainless steel is not available in 3-3/4" plate.

Little Goose RSW – VE

COMMENTS

- **C-1.** Consider feasibility of new coating technologies, rhino liner, etc for future hydraulic structure coatings. Applications for fish passage devices and or other hydraulic structures subject to wind/wave and debris damage may benefit from new coating technologies.
- **C-2.** Evaluate necessity of the number of eyes/connectors and frame for biological monitoring and testing equipment. Re-examine the methodology / number / location of biological monitoring equipments for the RSW in light of lessons learned from previous RSW installations and on new projected research needs for the future. The current design is patterned off the Ice Harbor RSW design, and the biological monitoring requirements may have changed (increased or decreased) over time.
- **C-3.** Evaluate construction of anchor tank. Investigate if more simplified structure can be designed for future pressure vessels.
- **C-4.** Consider use of alternate materials for spillway bay concrete repair (versus shotcrete).
- **C-5.** See VE-5 recommendation. To ensure quality of connections in underwater locations, welded joints as currently designed are recommended as the system reliability and access to joints underwater area concern. Consider use of banded connections where accessibility to the joints warrants. This may reduce the overall number of expensive welded connections.

Little Goose RSW - VE

Potential Additional Savings from Lo Mo/Ice

APPENDIX D

| VE Number | VE Description | LEAD | Potential Savings | Potential Costs due to VE | Total Net Potential Savings | Actual "Applied" VE Savings | Comments |
|-------------------------|--|-------|-------------------|---------------------------|-----------------------------|-----------------------------|--|
| VE-1 | De-Chlorination | Kyle | | | | | |
| | Alt-1, Remove redundant air stripper system | Kyle | \$26,354 | \$4,560 | \$30,914 | \$35,474 | Item implemented. |
| | Alt-2, Remove Chemical Feed System and the circulating pump | Kyle | \$10,131 | -\$560 | \$9,571 | \$9,011 | Item implemented. |
| VE-2 | | | | | | | Spec requirement was reduced as a result of VE considerations, from 300 lf. to 100 lf. Bid item 0010 for this work was \$25K, so the difference in savings are calculated. |
| | Shotcrete repair of spillway | Rick | \$87,359 | \$0 | \$87,359 | \$62,359 | This requirement was part of the contract. No savings realized |
| VE-3 | Forebay Survey - use existing information/data | Rick | \$32,724 | \$0 | \$32,724 | \$0 | This requirement was part of the contract. No savings realized |
| VE-4 | Remove forebay signage | Rick | \$23,957 | \$0 | \$23,957 | \$0 | Dropped from consideration - no savings |
| VE-5 | Closure Structure - pre-fab or pre-cast versus cast in-place | Bruce | \$0 | \$0 | \$0 | \$0 | |
| VE-6 | Stoplogs: | | | | | | |
| | Alt-1, one solid stoplog versus multiple logs | Bruce | \$0 | \$0 | \$0 | \$0 | Dropped from consideration - |
| | Alt-2, use floating bulkhead versus multiple logs | Bruce | \$0 | \$0 | \$0 | \$0 | Dropped from consideration - |
| | Alt-3, use Ice Harbor bulkheadDelete exiting from contract | Bruce | \$160,000 | \$0 | \$160,000 | \$0 | This requirement was part of the contract. No savings realized |
| VE-7 | RSW Handling - change support point to give a flush surface to bear during land | Kevin | \$35,712 | \$0 | \$35,712 | \$35,712 | Item implemented. |
| VE-8 | Support System - change RSW to be supported off the dam versus a footing | Team | \$0 | \$0 | \$0 | \$0 | Dropped from consideration during VE study |
| VE-9 | Ballasting - remove cementitious grouting | Rick | \$85,222 | \$0 | \$85,222 | \$85,222 | Item implemented. |
| VE-10 | | | | | | | This requirement was deleted from the contract. VE study estimated 80K savings +REA costs. REA was later revoked. |
| | rebar scan of pier noses | Team | \$0 | \$0 | \$0 | \$80,000 | The VE study may have had an error on costs. The VE study actually estimated 41K savings |
| VE-11 | Coatings - change coating system | Bob | \$20,000 | \$0 | \$20,000 | \$41,000 | Item implemented. |
| VE-12 | Air Compressor - potential long term cost savings in reduced O&M plant replacement | Phil | \$84,000 | \$0 | \$84,000 | \$84,000 | |
| Total Potential Savings | | | \$565,459 | \$4,000 | \$569,459 | \$432,778 | |

Little Goose RSW – VE

NEXT STEPS

- **PM/Design Team** accepts and implements proposals, unless decisions are made otherwise
- **PM/Design Team** considers comments and how to address them in the design
- **VE Study Team** should be available to assist and respond to questions and help implementation
- **VEO** monitors progress, tracks and reports actual savings, and assists in implementations

Little Goose RSW - VE

THANKS

Thanks to the design and VE study team.

Thanks especially to Jack for stepping in when I had to be gone for family emergencies.